YOLOv2 and Hierarchical Soft-Max Tree for US Traffic Sign Detection System

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PROBLEM STATEMENT

- A system can detect traffic sign with high accuracy and run on real-time (>30 fps).
- Ability to infer to its abstract type when seeing an unknown sign.

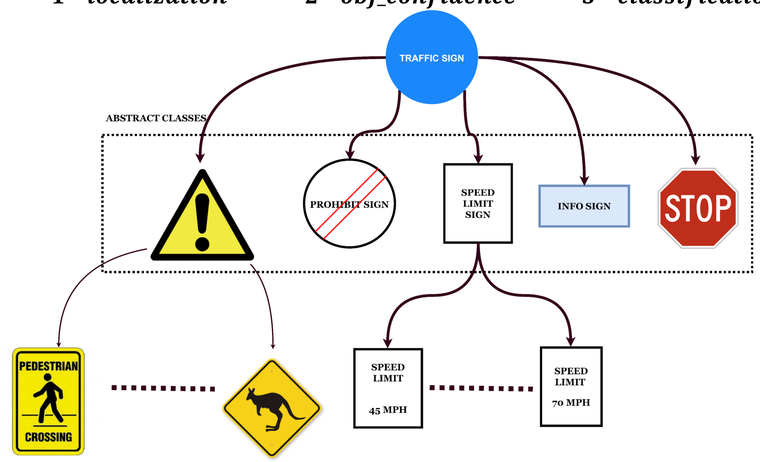
Approach

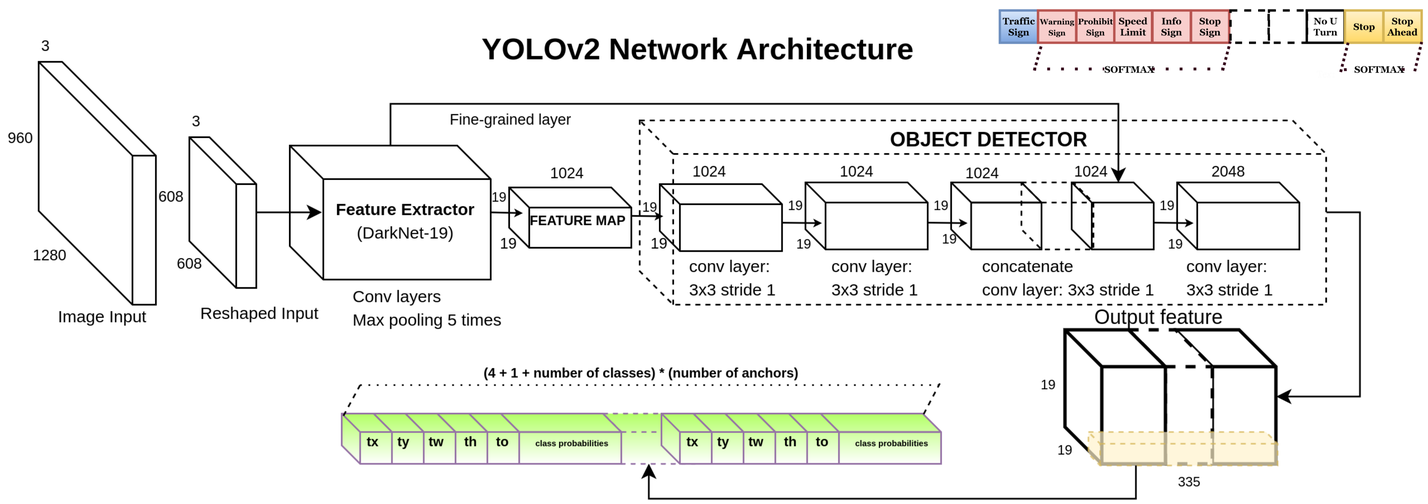
- Built a You Only Look Once version 2 (YOLOv2) for Traffic Sign Detection.
- Embedded prior knowledge of the dataset into the network through a hierarchical graph.

Methods

- Based on the standard YOLO-v2, we extended the network architecture by using light-weight CNN with higher input resolution [2] using Densely Connected [3] and Depth-wise Separable Conv. Layers [4].
- Objective Function :

$$w_1\mathcal{L}_{localization} + w_2\mathcal{L}_{obj\_confidence} + w_3\mathcal{L}_{classification}$$





EXPERIMENTS

- Trained on both LISA + LISA Extension, open-sourced US Traffic Sign Detection Dataset.
- Designed a Soft-Max Tree for joining multiple Traffic Sign dataset

RESULTS

Network	Resolution	Parameters	mAP (*)	Forward Pass(**)
Original YOLOv2	608x608	50.8 M	76.8	36ms
Mobile-YOLOv2	960x960	6.78 M	82.8	**20ms**
Densely-YOLOv2	960x960	10.6 M	**90.8**	55ms

(*) mAP is calculated on actual labels, without abstract classes. Also, this result is preliminary. Additional training might increase the result.
(**) Validated on NVIDIA GTX 1080.

FUTURE WORK

- Use Recurrent Neural Network to take advantage of temporal information.
- Train on larger dataset.
- Occlusion Detection.

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References

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